

A CASE
OF
TUMOUR IN THE BRAIN,
WITH
REMARKS ON THE PROPAGATION OF NERVOUS INFLUENCE.
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THE following case I take the liberty of communicating to the Society, principally on account of some of the circumstances attending it, being connected with a very obscure fact in the pathology of the brain, viz. that of compression in one side of that organ, producing paralysis in the opposite side of the body.

David Thomas, a man of a fair complexion, and of about thirty-six years of age, became my patient in the General Dispensary in December 1806, on account of a slight paralysis of the right side, and a distortion of the left eye. He had been subject, for

twelve months before, to occasional severe attacks of pain of the head, shooting from behind forwards; and about six weeks previous to my seeing him, he was surprised, on awaking in the morning, to find his left eye drawn inwards, and his vision double. In two or three days more, his right hand became weak; and this was gradually followed by weakness, and afterwards by numbness of the corresponding leg and side; and by a slight stammering, and a small degree of distortion of the mouth.

These symptoms continued when I first saw him, with some degree of head-ache, and his pulse about sixty-eight, and rather weaker in the affected than the sound arm. In other respects he was in his accustomed state of health. The left eye was drawn towards the nose, but the pupil was in its usual state of sensibility to light. The double vision continued. All voluntary power over the abductor muscle was lost; nor did the affected eye, as in common cases of strabismus, recover its usual position on shutting the sound one. He had been purged and blistered by a gentleman well versed in the treatment of complaints of the eye, when the distortion first came on; but he ceased to be under his care on the paralysis supervening.

In little more than a week from the time of my first seeing him, he became at first slightly, and then considerably affected with convulsive motions of the whole body. These recurred at more and more

frequent intervals, he became gradually less and less sensible, and died in about twenty-four hours from their commencement. I saw him a few hours previous to his death. He was then in a state of insensibility, with his eyes suffused, his pulse weak, frequent, and fluttering, and his respiration laborious. The distorted eye had recovered its usual position a few hours before, and the pupils were insensible to the action of light.

On dissection, the brain was found to be of an unusually firm texture, with about half an ounce of water in the ventricles. There was no diseased appearance in the right side of the head, but in the left, a tumour was discovered on the tuberculum annulare, which my friend and colleague Mr. Thomas Blizard, surgeon to the London Hospital, did me the favour to examine with me. 'It was about the size of a hazel-nut, and was lying on, and sunk into the tuberculum, at its posterior part, on the left side. It extended to the corpus pyramidale of the same side, pressing upon, and entirely obscuring the left abductor nerve. The tumour was closely connected with the basilar artery, half an inch from the union of the vertebrals to form it; and the coats of this artery had become so tender, that they readily gave way from the application of a probe, which passed through the tumour. The tumour was in a state of imperfect suppuration, and a small coagulum was formed on the diseased point of the artery, similar to what is found in aneurismal arteries.'

The tumour now described, agreed very much in nature with those, which various authors on the subject of morbid anatomy have mentioned, as being occasionally found in the brain. It seemed to be of a scrophulous nature, and its appearance and imperfect suppuration were analogous to those of scrophulous tumours, formed on the surface, or in any of the cavities of the body. The pressure which it made on the tuberculum annulare and medulla oblongata, there appears to be no doubt, gave rise to the pain of the head, the strabismus, the gradual production of paralysis, and the convulsions which occurred in the latter period of the patient's life. The distortion of the left eye towards the nose, was the necessary consequence of the nerve being affected, which gave energy to the abductor muscle of the eye; and as it arose from the preponderating influence of its antagonist, the abductor, it went off at that period, near the close of life, when the whole nervous system became in a great degree inert.

The pressure which was made on the basilar artery, had produced a considerable thinness and tenderness in its coats, so as to make them readily give way, on the application of a probe. Had this gone on a little further, the patient must have lost his life by the vessel giving way, from its inability to resist the pressure of the column of blood which passed through it.

With regard to the treatment of this complaint, I

had directed a blister to be applied and kept open in the neighbourhood of the head, and a gentle mercurial course to be commenced; but the short period of the patient's life under this plan, rendered it impossible to form any opinion of its probable efficacy.

I am inclined to think, that in such cases, mercury affords the best prospect of advantage, both from its good effects in obstinate head-aches, not connected with venereal infection, and from the advantage arising from its exhibition in mesenteric obstructions.

The paralysis which took place in the present instance, afforded an example of compression in one side of the encephalon, producing a diminution of voluntary power over the opposite side of the body; and the particular local situation, and precise effects of the pressure, were more distinctly marked than generally happens in paralytic affections. The consideration of the circumstances of this case, and the difficulty of obtaining any precise and consistent details concerning this curious phenomenon, have induced me to think, that it may not be altogether useless to inquire, what are the particular parts to which it applies, and whether we are in possession of any facts, which will enable us to form a rational conclusion concerning its mode of production.

The nerves which supply that part of the body which is affected in hemiplegia, are, with very few exceptions, derived from the medulla oblongata, and

its continuation the spinal marrow. It is proper therefore to consider, in what manner these substances are connected with the other parts of the encephalon. The medulla oblongata assumes, at its upper part, a bulb-like form ; and it is there united to the tuberculum annulare, or, as it is also termed, the pons varolii. This last is formed by the union of the crura of the cerebrum and the cerebellum ; and it is the only channel of communication between these substances and the spinal marrow.

But as the tuberculum annulare, and the medulla oblongata and spinalis, are the only media by which the united influence of the cerebrum and cerebellum can be propagated to the nerves which derive their origin from the spinal marrow, and which are therefore principally affected in the production of hemiplegia, I shall consider, whether there is reason to suppose, that nervous energy, in whatever that may consist, is in its progress to the spinal nerves, confined to the particular side from which those nerves proceed ; whether it is subject to any decussation ; or whether it is equally dependent, for its propagation, on the whole spinal column.

The structure of the spinal marrow, and the effects of compression or other injuries on particular portions of it, are subjects intimately connected with these inquiries, but concerning which anatomists are very discordant, and some of them not altogether consistent.

HALLER describes it as consisting of two columns, a right and left, principally made up of medullary substance, and separated, both in the anterior and posterior parts, by a furrow. He has not observed any fibrous appearance in the course of it; but in the medulla oblongata he remarks, that on separating the furrow which divides the corpora pyramidalia, some transverse medullary fibres present themselves, which he never observed to decussate.

With regard to the effects of pressure, or other injuries on the medulla spinalis, he informs us, that that side of the body becomes paralytic, in which the spinal marrow had suffered a wound or pressure*; but at the same time, in another part of his work, he states that if one half of the medulla spinalis is divided, the muscles of the opposite side are paralyzed†. From hence it is evident, that Haller did not, in this particular instance, speak from his own observation.

* In medulla spinali, nihil simile locum habet, & id latus corporis resolvitur, in quo, ea medulla vulnus passa est aut pressionem.

Haller's Elementa Physiologiæ, tom. 4. p. 334.

† Alterius demum lateris, muscoli resolvuntur, si dimidiam medullæ spinalis dissecueris.

Haller's Elementa, tom. 4. p. 326.

Si minus malum fuerit in medulla spinali, perinde etiam, aut non penitus motus artuum inhibetur, debilitatur tamen, aut alterius lateris muscoli resolvuntur.

Haller's Elementa, tom. 4. p. 327.

SCÆMMERING also divides the medulla spinalis into two lateral columns, each of which, however, he considers as being composed of an anterior and posterior one. He has not noticed any medullary fibres in its progress, but with Haller, he describes an appearance of medullary fibres in the medulla oblongata, which he informs us, begin to decussate immediately below the ninth or lingual nerves *. Of the phænomena produced by injuries on the spinal marrow, he says, that the same side of the body is generally affected, as that in which the injury is sustained †; but this is difficultly reconcileable to another passage, in which he gives it as his opinion, “that it is highly probable, that the fibrils of the spinal nerves, every where belong to the opposite side of the body to that in which they are dispersed.” ‡

* Mox infra nervi lingualis medii originem, fibræ medullæ mutuo se secare incipiunt, facileque id leniter utraque parte medullæ spinæ & dextra et sinistra, a se invicem distracta, observari potest.

Scæmmering de Corporis Humani Fabrica, tom. 4. p. 78

† Læsa vero spinæ medulla latere, plerumque idem corporis atus adficitur.

Scæmmering, tom. 4. p. 87.

‡ Quod cerebri nervos attinet, ad oculos id quidem demonstrari nequit, veruntamen, quod spinæ medullæ fasciculi inter se implicantur, fila nervi medullæ spinæ ad latus oppositum ei in quo sparguntur, passim pertinere, verosimile videtur.

Scæmmering, tom. 4. p. 121.

That this is not an unusual idea, appears from the following quotation from Bichat. Ils sont cru (plusieurs physiologistes) que les nerfs d'un côté, naissent du côté opposé; et qu'il y a entrecroisement dans chaque paire, non seulement au cerveau, mais encore a la moelle épinière.

Bichat's Anatomie Générale, tom. 1. p. 120.

Upon the whole, it does not appear that Soemmering brings forward any decisive evidence of his own upon this matter. *

SABATIER describes the medulla spinalis as composed of two lateral columns, placed close together, and separated, both in the anterior and posterior parts, by a furrow, into which vessels enter. He has not observed the fibres which some have described as passing from one side of it to the other. †

VICQ D'AZYR has particularly attended to the structure of this prolongation, and is likewise of opinion, that it consists of two lateral columns pressed together, and having a furrow between them through the whole extent of both the anterior and posterior surfaces. In the anterior part, between the columns, and some way below the surface, he has observed, through the whole length of the medulla spinalis, a white and very fine lamina, which he conceives acts the part of a species of corpus callosum or commissure, joining the two lateral columns. In the posterior part, on separating the edges of the sulcus, instead of a white lamina, he found a portion of cortical matter, which was disposed longitudinally in the centre of each spinal column, and stretched over from one side to the other, as a kind of corti-

* See the Note at the end of the volume, p. 290.

† Sabatier sur quelques particularités de la structure de la moëlle de l'épine & ses enveloppes.

Memoires de l'Acad. Royale des Sciences pour l'année 1783.

cal commissure. In the medulla oblongata, the same structure prevails, except that on separating the edge of the sulcus, between the corpora pyramidalia, some fibres present themselves, which he says are always either transverse, or a little oblique, but never decussate ; and which he supposes, like the lamina mentioned above, also act as commissures. *

From the accounts which I have given of the observations made with regard to the structure of the medulla spinalis, by some of the principal authors, there seems to be no sufficient evidence for believing, that there is a regular decussation of the fibres of this body, or a propagation of nervous influence from one side of it to the other. All anatomists admit the existence of two longitudinal columns in the spinal marrow ; and Sœmmering's idea of the fibrils of the spinal nerves every where belonging to the opposite side of body to that in which they are dispersed, seems to be only an inference, made from a supposed analogy to what he considers as applying to the structure of the medulla oblongata, without its being supported by any observations mentioned by him, on the structure of the medulla spinalis itself. Anatomical inquiry on this subject is very difficult ; and the different accounts of it, given by the best anatomists, shew that it is in want of further investigation.

* Vicq d'Azyr's *Recherches sur la structure du cerveau*, &c. troisième mémoire ; *Memoires de l'Acad. Royale des Sciences pour l'année 1787*.

I shall proceed to inquire, how far experiment, observations made in disease, or the structure of analogous parts in other animals, will throw any light on the particular questions which I have stated relative to the spinal marrow.

The power which the spinal marrow has in the propagation of nervous influence, seems to have called for the particular attention of Galen. He states with precision, the effects of dividing the spinal marrow at different parts of its course transversely, and then goes on to the consideration of longitudinal, and semi-transverse divisions. Where the spinal marrow was divided longitudinally, he found that none of the nerves which were derived from it on either side, were paralyzed; when transversely, that the nerves only were paralyzed, which were directly below the part divided on the same side. *

If it be true, that in the spinal marrow, the fibres, or other medium of the propagation of nervous influence, decussate in such a manner, that the influence afforded to the nerves of one side, is supplied from the other, it seems to follow, that a longitudi-

* Κατὰ μὲν τὸ μῆκος ἄνωθεν κάτω μέσος εὐθείᾳ διαιρέσει τεμνόμενος καὶ νωτιαῖος, ὑδέτερον τῶν ἐν τοῖς μεσοπλευρίοις παραλῦει νέρων. ἔτι· τὰ κατὰ τὰ δεξιὸν μέρος ἔτε τὰ κατὰ βάτερον, ὥσπερ ὁδὲ τὰ κατὰ τὴν ἰσφὺν ἢ σκέλη. διέγκασίας δὲ ἐπειδὴν διαιρεθεῖη μόνον αὐτὸ τὸ ἥμισυ μέρος· εἴτ' οὖν ἀριστερόν· εἴτε δεξιόν; ἅπαντα ἕξῃς παραλύεται τὰ κατὰ εὐθεῖαν τῇ τμηθέντος μερὸς νεῦρα.

Galen de Anatomicis Administrationibus, lib. 8. sect. 6.

nal incision of the spinal marrow, such as was made by Galen, will have the same effect as a transverse one, in producing a paralysis of both sides ; for if the propagation is either oblique or transverse, a longitudinal incision must interrupt it.

It likewise appears to be a fair inference, that if the two sets of fibres mutually intersect each other, and if, in consequence, the nervous influence is propagated in the mode of decussation, one side of the spinal marrow can neither be pressed upon, nor otherwise hurt, without injury to the functions of the nerves proceeding from both sides : for the spot where the injury is received, must be both the origin of nervous influence to the opposite nerves, and the place whence nerves are actually given out, though deriving their energy from the contrary side.

In Spina Bifida, cases are sometimes met with, in which water is contained in a species of canal in the middle of the spinal marrow, communicating with the fourth ventricle ; and hence it has been supposed by some, that this canal exists naturally. The probability of such a circumstance is noticed by Portal ; and Sabatier and Boyer evidently give credit to its occasional occurrence *. In such instances, the pro-

* L'examen de la moëlle épinière de divers sujets, a fait voir dans son milieu, un canal grêle, qui descendoit plus ou moins bas et qui communiquoit supérieurement avec le quatrième ventricule ; il paroît convenable de penser qu₂ ce canal existe natu-

pagation of nervous influence would most likely have been interrupted, and a paralysis in the parts below produced, if there had been a decussation of fibres, and a crossing of nervous influence in consequence of it, in the course of the vertebral column. It may be remarked too, that in the course of the spinal marrow of some animals, there is a species of canal found, containing a portion of fluid. This is the case with the eagle and most other birds * ; and I am informed by Mr. Cooper, that a similar structure was lately shewn him by Mr. Sewell, of the veterinary college, in the spinal marrow of a horse.

rellement, mais qu'il ne devient bien apparent, que par état de maladie, comme dans les sujets morts du Spina Bifida; chez eux, on trouve quelquefois un canal bien formé au milieu de la moëlle épinière, & dans une assez grande étendue.

Portal's Cours d'Anatomie Medicale, tom. 4. p. 62.

Portal in a paper on Spina Bifida, in the Memoirs of the Royal Academy of Sciences for 1770, gives the case of an adult, in whom such a canal was found without the production of paralysis.

Sabatier says of this canal " cependant elle n'est pas encore prouvée par un assez grand nombre de faits, pour être regardée comme constante." *Sabatier's Traité d'Anatomie*, tom. 2. p. 45.

Boyer makes the same remark, and nearly in similar words.

Boyer's Traité Complet d'Anatomie, tom. 4. p. 65.

Morgagni mentions an example of there being, in the body of a fisherman, a natural canal of considerable size and extent, in the middle of the spinal marrow, at its upper part. He does not remark that there had been any paralytic affection, and speaks of this, as a well-marked example of not an unfrequent occurrence. *Morgagni Adversaria Anatomica*, 4. *Animad.* 14.

* *Perrault's Description Anatomique de trois Aigles*. Mem. de l'Acad. Royale des Sciences, tom. 3.

In insects and worms the medulla oblongata comes from the brain in two separate columns, which continue disunited through the whole extent. *

These analogies afford a certain degree of presumptive evidence in favour of the directly downward propagation of nervous energy, and of a certain degree of independence which one side of the spinal marrow has of the other ; and against the decussation of fibres, or the existence of any particular structure necessary to the decussation of nervous influence : since it is difficult to conceive, that a canal, or division, such as I have noticed, is compatible with a regular interchange of nervous energy, when the fibres, or medullary matter which is supposed to be the medium of its propagation, are interrupted.

Some instances have been known, in which persons wounded in the spinal marrow, have lived for a considerable time, and without any paralytic affection supervening. In such cases it is probable, that the medulla spinalis has been longi-

* Dans les insectes & les vers, la moëlle épinière est formée dans son principe, de deux cordons paralleles & écartés l'un de l'autre, & chacun de ces cordons est composé de tumeurs ganglioformes, d'ou sortent des Nerfs qui en sont eux mêmes dépourvus. J'ai fait voir que dans l'homme, la moëlle épinière peut être également divisée en deux parties laterales très-distinctes. *Vicq d'Azyr's* Suite des Recherches sur la Structure du Cerveau. Mem. de l'Acad. Royale des Sciences pour l'année 1783.

tudinally, and not transversely divided * ; since it is well known that when a transverse incision has been made, either by design or accident, a paralysis of the parts beneath was the consequence. On the principle of decussation, it is indeed difficult to conceive a wound of the spinal marrow in any direction, which would not have the effect of dividing a part of the medium of nervous communication.

A case lately occurred to my friend Dr. Marcet, physician to Guy's Hospital, which was seen by him in consultation with Dr. Baillie and Dr. Bourne of Oxford, and was attended by a great number of very anomalous symptoms, particularly severe pains in the left side of the abdomen. In this case, a tumour was found on dissection, pressing upon the lower dorsal vertebræ on the left side, which had rendered carious the last vertebra but one. A few days previous to death, a paralysis of the lower extremities came on, which was much greater in the left side, where the tumour pressed, than in the right. †

* Mais dans la plupart de ces cas cités, ou la moëlle épinière n'avoit pas été atteinte, ou ne l'avoit été qu'à sa partie inférieure, & longitudinalement ; de manière que les filets de la substance médullaire de ses nerfs, avoient été vraisemblablement plutôt désunis, que coupés.

Portal's Cours d'Anatomie Médicale, tom. 4. p. III.

† Portal mentions a case, from which he considers it as proved, that an injury of one side only of the spinal marrow, as well as of the medulla oblongata, gives rise to convulsions or paralysis of the opposite side of the body. It is of a female,

The result of Galen's experiment of the longitudinal division of the spinal marrow, seems, with the other circumstances which I have mentioned, to render any decussation of nervous influence in the course of the medulla spinalis extremely improbable. The other experiment stated by him, of the effects of a semi-transverse division of this body, may be considered as decisive of the question; but at the same time, as the expressions employed by him in narrating it are not very precise, though there appears to be no doubt that they bear the interpre-

who was, for a long period, affected with convulsions in her left leg, at the time of the menses; and when they ceased, the limb became paralytic. Soon afterwards, the arm of the same side became convulsed, and in a short time she died of what he calls a comatose affection. The arachnoid coat and pia mater of the medulla spinalis, at the last dorsal and first lumbar vertebræ, were found to be inflamed; and the medulla itself to be red and soft on the right side, but sound throughout its whole extent on the left.

On this case I beg leave to remark, that the cause of the paralysis seemed to be in some way connected with that of the convulsions; but the arm became convulsed, without any cause being discoverable by dissection in the upper part of the spinal marrow; and a comatose affection came on, which destroyed the patient, and yet no diseased appearances are mentioned which can account for it. The coats of the spinal marrow, it would appear, were inflamed all round, though in the marrow itself, the affection was only seen on the right side. For the affection of the arm, and the coma, the diseased appearances cannot account; and had these appearances been of long standing, the coats must have been much thickened, instead of only exhibiting the marks of recent inflammation. The state of the brain itself is not mentioned. *Portal*, l. c. p. 116.

tation stated above; and as it was desirable to ascertain the accuracy of Galen as an experimentalist, I considered it proper that the experiment should be repeated *. I therefore requested my friend Mr. Astley Cooper, surgeon to Guy's Hospital, to repeat, on a dog, the experiment of dividing one half of the spinal marrow transversely. The following is the account of the mode of performing it, and of

* I have the authority of two gentlemen of very distinguished classical attainments, for the interpretation given of the paragraph in question. It is very singular, that Haller quotes the particular section of Galen from which this paragraph is taken, for the statement mentioned at page 187, that when one half of the spinal marrow is cut through, the muscles of the opposite side are paralyzed. I may remark, that this is the only passage in the section which bears upon the question.

The authority of Aretæus is quoted by Haller, among some others, for the observation also mentioned in a note at page 187 of this paper, in which it is stated, that a partial injury of the medulla spinalis, short of division, produces a paralytic affection of the muscles of the opposite side. On referring, however, to the passage, in book 1st, of the Chronic Diseases, chap. 7th, it appears, that an inaccuracy has crept into Haller's great work, similar to that mentioned relative to the quotation from Galen; and that the opinion meant to be conveyed by Aretæus is, that in consequence of an injury done to one side of the spinal marrow, the nerves of the same; and not the opposite, side are paralyzed. The passage is the following:—
 Ἦν μὲν οὖν τῆς κεφαλῆς κάτω πάθη, τις ἀρχή, ὁκῶιον τι τῆ νωτιαίῃ μυελῷ ἢ μῆνινξ, τὰ ὁμώνυμα καὶ ξυναφέα παραλυεταί, δεξιὰ ἐπὶ δεξιῶσι, καὶ ἐπ' ἀριστερῶσι λαιά. Ἦν δὲ κατ'ἀρχὴν κεφαλῇ, ἐπὶ μεντοῖσι δεξιῶσι, τὰ λαιὰ παραλυεταί, δεξιά δὲ ἐπ' ἀριστεροῖσι.

the circumstances which we noticed in consequence of it.

After dividing the integuments, and dissecting down to the sheath of the spinal marrow, between the occiput, and the first vertebra, part of the sheath was removed, and the spinal marrow laid bare. The point of a probe was then thrust into the spinal marrow at its raphé, and into the wound made by it, the end of an eyed probe was introduced. By this last, the marrow was divided on the right side.

Immediately after the division, the animal seemed dead and stiff, its efforts to resist having entirely ceased. On taking away the ligatures by which it had been secured, all its limbs still appeared rigid ; but in the course of two or three minutes, it was observed, that the elevation and depression of the ribs in respiration, were almost entirely confined to the left side. When the animal was laid upon its back, it was found that both the extremities of the left side were more stiff than those of the right ; and that on bending them, they immediately recovered their position, and remained stretched out. The extremities of the right side, on the other hand, were more flaccid, and retained any position in which they were put.

There was a degree of tremor in the muscles of the left extremities, which was principally observed during inspiration, and when the animal lay on the

side in which the spinal marrow had been divided. The tail, at the basis, was drawn to the left side.

The animal turned over twice, within half an hour after the operation ; but the movement was made by the action only of the left side, the right remaining flaccid. He several times made an attempt at stretching himself, in which he succeeded so far, as to extend and draw back the extremities of the left side. His respiration was full and equable ; but the action of the intercostals seemed, as before remarked, to be confined to the left side. He two or three times made a barking noise. He could move his head slightly, and seemed to have the full power of motion over his eyes and eyelids, and the muscles of his face. His hearing was not affected. He twice passed his urine in the course of a few hours. He did not lap, when milk was set before him, and he was lifted up and his mouth put to a vessel containing it ; but when a small portion was poured into his mouth, he moved it about with his tongue, and seemed to swallow it.

The flaccidity of the side in which the operation was performed, increased ; but in a couple of hours he had a slight power of motion over the tail, which gradually augmented, so as to enable him to move it back and forward pretty readily.

He lived till the following morning, and was seen by Mr. Cooper, a short time previous to his death.

He was then affected with convulsions in both sides, which were less in that in which the operation had been performed, than in the left. He seemed also, at this time, to be able slightly to extend the extremities of the same side. The respiration went on as it had before done, and was still unattended with any action of the right intercostal muscles.

On the second evening after his death, we examined him. The pia mater, near the place where the operation was performed, was much inflamed; and when it was removed, the medulla spinalis was found to have had its right half very accurately divided. The choroid plexus was more turgid than ordinary, and the bottom of the ventricles, particularly of the fourth, and that part of the third which was nearest to the passage to the fourth, was covered with minute red vessels.

From the above experiment, there appears to be a decisive confirmation afforded of Galen's accuracy, and of the opinion which the circumstances above mentioned seem to favour, viz. that the same law as to the seat of paralysis, which applies to the encephalon, does not apply to the medulla spinalis. At the same time, however, there is reason to suppose, that the two sides of the medulla spinalis are not perfectly independent of each other: for immediately after the operation, the whole body was for some time rigid; and before death, both sides were

affected, though unequally, with convulsions. This last circumstance, together with the power which the animal recovered over the motion of the tail, and the slight resemblance of voluntary exertion which appeared in the extremities of the right side, seems to shew, that a reciprocal influence exists between each side of the spinal marrow ; or between each side of the body, by means of nervous inosculation. Vicq d'Azyr's Anatomical Observations on the Structure of the Spinal Marrow, are in favour of the former opinion.

I may remark, that the circumstance of Galen's not noticing any thing but the result of his experiment, does not at all affect his accuracy ; because he refers for minute particulars to the fourteenth volume of his works, which has never been found.

Much of the reasoning, and many of the facts which render it probable, that nervous energy is propagated directly downwards in the spinal marrow, and does not decussate, seem to apply likewise to the medulla oblongata ; for the one is regarded by anatomists as a mere continuation of the other, and by many of them is considered* as not at all different in structure. *

* La moëlle de l'épine est le prolongement de la moëlle allongée dont elle ne diffère pas, que par ses dimensions & par le lieu qu'il occupe.

Sabatier's Memoire sur quelques Particularités de la Structure

Some experiments, however, made by M. Lorry, and published by the French Academy of Sciences, in their *Memoires des Savans Etrangers*, seem to him to prove, that a wound or division of one side of the medulla oblongata, will produce a paralysis of the opposite side of the body; in which case it would follow, that this substance, of which the spinal marrow is a direct continuation, does not follow the same law to which the latter is subject on pressure or other injury, but is obedient to that which regulates the encephalon in general. *

Such experiments, it must be owned, are very liable to error; both from the part to be wounded being incapable of injury, without neighbouring parts also suffering; and from the discharge of blood

de la Moëlle Epinière & ses Enveloppes. *Memoires de l'Acad. Royale des Sciences*, 1783.

A spinali medulla non credidi separari debere, quæ nullo evidente limite distinguatur, cum ne transitum quidem per atlantem in hominis integro cerebro, facile sit agnoscere.

Haller's Elementa Physiologiæ, tom. 4. p. 79.

— nor perhaps is the medulla oblongata to be considered in any other light, than as the beginning of the spinal marrow. —

Bell's Anatomy, vol. iii. p. 110.

Sæmmering gives the term of medulla spinalis to the medulla oblongata, as well as its continuation, the spinal marrow.

Sæmmering, tom. 4. p. 75.

* Lorry sur les Mouvements du Cerveau. *Memoires des Savans Etrangers*, tom. 3. 1760.

in some degree affecting the result of the experiment. It is therefore rather by the accidental observations which the study of morbid anatomy furnishes, than by actual experiment, that legitimate conclusions, concerning the precise influence of such a deep-seated part, are to be drawn.

The animals on which M. Lorry principally made his experiments were pigeons ; and on wounding, by ten or twelve punctures, the medulla oblongata on either side, he found that there was a certain degree of weakness produced on the opposite side of the body. It may be remarked, however, upon these experiments, on which he seems to have laid the principal stress in the establishment of his conclusion that the medulla oblongata follows the same law to which the encephalon is subject in compression or other injury, both that the results were not perfectly unequivocal, and that the animal to which he principally confined them, was not, in the structure of the encephalon, well adapted for them.

Pigeons, and other birds, have only one lobe in the cerebellum ; and in the place of having a tuberculum annulare, in which the crura of the cerebrum and cerebellum unite, are without that organ *. The

* *Cuvier's Leçons d'Anatomie Comparée*, tom. 2. p. 161.

Lawrence's Blumenbach, p. 299.

Haller & Vicq d'Azyr mention the existence of a tuberculum annulare or pons in birds ; but from a comparison of what they say upon this point in different parts of their observations on

upper part of the medulla oblongata seems to answer the purpose of the tuberculum annulare ; but as the crus of the cerebellum goes into the medulla oblongata, at some distance behind the union of the crura of the cerebrum, and at but a short space from the occiput, it seems likely that in making punctures, particularly in ten or twelve places, he would injure the medulla oblongata, at the place where the cerebellum joins it, and thus defeat the object of the experiment.

We are not informed of the particular mode in which these experiments were made, except as far as I have stated it ; but they could hardly, it appears to me, be performed, without injuring the cerebellum, a circumstance which I should think would materially affect their results : and indeed the same effect which is attributed to a wound of the medulla oblongata, followed, in another experiment made by him, the mere puncture of the cerebellum, when it was made expressly to avoid the medulla oblongata ; though in this experiment he does not mention the side in which the weakness was produced. It may also be remarked, that slight effusions of blood were

the anatomy of birds, it is evident, that they both refer to that continuation and expansion of the medulla spinalis, into which the arbor vitæ of the cerebellum enters, and which may be more properly designated as the medulla oblongata, than the tuberculum annulare.

Haller's Opera Minora, tom. 3. p. 193, &c.

Vicq d'Azyr, l. c.

found on the medulla oblongata, on the side opposite to that which had been punctured.

M. Lorry's experiments therefore, seem to be deficient in the evidence necessary to establish the conclusion, that an injury on one side of the medulla oblongata, produces a paralysis in the opposite side of the body. *

The pathological evidence of which we are in possession upon this subject, seems to be in favour of the idea, that a wound or pressure on the medulla oblongata, as well as on the medulla spinalis, will affect the same, and not the opposite side of the body.

It is a matter of common observation, that the tongue and velum pendulum, and occasionally the muscles of deglutition, are affected, in hemiplegia, in the same side, as that in which other voluntary muscles are paralyzed; and by a cause acting in the opposite side of the head†. When we

* M. Lorry, though he trusts principally to his experiments on pigeons, mentions one experiment on a dog. The result of this however, was not perfectly unequivocal; and in addition to the sources of error which I have stated as likely to attend experiments on the medulla oblongata, I may mention, as an objection to it, that it was not followed by an examination after death.

† I have not noticed the paralysis of the muscles of the face, not only because it is difficult to ascertain whether it arises from

consider, however, that this circumstance can only take place from an affection of the glosso-pharyngeal or lingual nerves, which arise at, or near the upper part of the medulla oblongata, there is reason to suppose, that there is not only a certain degree of independence which one side of the medulla oblongata has of the other, but that, in the phenomena exhibited on nerves proceeding from it, by the effects of pressure on the opposite side of the brain, it is completely assimilated to the spinal marrow. This opinion, also, receives some degree of support, from the analogy which the structure of the medulla oblongata bears to that of the medulla spinalis, and from the division which exists in the former, as well as in the latter, in some species of animals.

When we advance further in the encephalon, in the inquiry as to the effects of pressure, the difficulties of obtaining any precise or particular information increase.

That pressure on the tuberculum annulare on one side, affects the opposite side of the body, is evident

an affection of a branch of the fifth pair of nerves, or of the portio dura of the seventh, both which supply the face; but also because the origin of the latter has been referred by some distinguished anatomists, to the crus of the cerebellum, and not to the upper part of the medulla oblongata. In this case, it is obvious, that the same reasoning could not be applied to the portio dura of the seventh pair, which I have considered as applicable to the glosso-pharyngeal and lingual nerves.

from the case which I have given at the commencement of this paper, in which the tumour discovered was found on the left side, while the paralytic affection was on the right.

The effects of pressure on either hemisphere of the brain in producing paralysis on the opposite side of the body, is a fact which is noticed by almost every pathological writer since the time of Hippocrates, and is that from which the general law relating to the encephalon has been deduced. *

Whether the cerebellum is similarly circumstanced with the cerebrum in the effects of pressure, is a circumstance concerning which doubts have been entertained.

* It sometimes happens, that a hemiplegia has its cause in the same, and not the opposite side of the brain. Haller quotes some instances of this. Vid. *Elementa Physiologiæ*, tom. 4. p. 333. Some other authors notice the same. This must be regarded as one of those deviations from the ordinary laws of the animal œconomy, which are occasionally observed in every part of the body.

From the following Aphorism deduced from anatomical observations on injuries of the head, Vicq d'Azyr seems to doubt the fact. " Que la paralysie se montre toujours du côté opposé à la compression, puisque dans une circonstance où les muscles s'affoiblirent du même côté que la blessure, l'épanchement, par l'effet de la commotion, s'étoit fait dans un point opposé à celui du coup."

Œuvres de Vicq d'Azyr par Moreau, tom. 5. p. 359.

Morgagni mentions two or three examples in support of them. Bianchi published a case expressly of this kind, and Portal gives some credit to the circumstance, but says, that it is not sufficiently proved to be considered as an established point of doctrine *. That this point should not yet have been fully ascertained, may perhaps be owing to injuries of the cerebellum, and morbid alterations in that body, having been much seldomer the subjects of observation, than such as appertain to the cerebrum.

An inquiry into the cause why one side of the body is affected by pressure on the opposite side of the head, and not the other or both, is still more difficult than an examination into the particular facts on this subject, as applying to the different parts of the encephalon.

The most reasonable cause which, as far as I can judge, has been assigned for this phænomenon, is that of a decussation taking place somewhere in the sensorium, or its prolongation the medulla oblongata or spinal marrow, by means of which the nervous energy, instead of being propagated in a straight line, proceeds crosswise.

* Morgagni de Sedibus & Causis Morborum, epist. 52. sect. 27.

Bianchi's Storia Medica d'una Pestema nel Lobo destro del Cerebello.

Portal's Leçons d'Anatomie Medicale, tom. 4. p. 105.

This is the idea proposed by Aretæus, and assented to by almost every pathologist since his time. *

The appearance of transverse, oblique or decussating fibres in the medulla oblongata, on separating the edges of its raphé, has been regarded by some as affording a proof, that the decussation which is conceived to be necessary, in order to account for the phænomenon in question, takes place in this body. There seems, however, to be no evidence of this, further than the existence of fibres, which Haller, Morgagni, and Vicq d'Azyr, though they admit them, do not consider as decussating. Santorini referred the place of decussation to the tuberculum annulare, as well as the medulla oblongata; and was induced to consider it as taking place in the latter, from the circumstance of the existence of fibres, which appeared to him to decussate †. We are informed, however, by Vicq d'Azyr, that M. Girardi, the editor of the posthumous works of Santorini, examined thirty-four brains, in order to ascertain whether the decussation mentioned by him takes place; but was

* Aretæus states, that the nerves, instead of running in straight lines from their origin to their termination, decussate in the form of the Greek letter X; ἀλλήλοισι 'παλλαξάμενα εις χιασμον σχηματος. *Aretæus de Causis & Signis diuturnorum Morborum*, lib. i, cap. 7.

See also Morgagni de Sedibus & Causis Morborum, and Burserii Institutiones Medicinæ Practicæ, tom. 3. p. 70.

† Santorini's *Observationes Anatomicæ*, cap. 3. sect. 12.

not able to convince himself of the fact *. Vicq d'Azyr himself, considers the fibres as nothing more than commissures, and not at all connected with the phænomenon in question †; and Boyer is of opinion, that the decussation of the fibres of the medulla oblongata cannot be at all demonstrated. ‡

Sabatier, on the other hand, conceives that the appearance of fibres at all, where they have been described, is merely owing to the medulla

* Vicq d'Azyr's *Traité d'Anatomie & de Physiologie*, p. 110.

† S'il m'est permis de parler de mes travaux, apres avoir rendu compte des ceux des anatomistes les plus distingués, je me contenterai de dire, qu'en écartant les corps pyramidaux, j'ai vu entre eux, non des fibres qui se croisent, mais de petits cordons qui se portant d'un coté à l'autre, les uns transversalement, les autres obliquement, font dans la mœlle alongée, l'office des commissures. *Ib.* p. 110.

M. Petit, of Namur, was one of the first who mentioned the existence of decussating fibres in the medulla oblongata. I have not, however, been able to procure a sight of his memoir. Vicq d'Azyr gives him great credit as an anatomist, but says of his opinion relative to this point, " On peut lui reprocher, d'avoir montré peut être, un peu de prevention, dans le système qu'il avoit adopté, sur le croisement des fibres du cerveau."

Vicq d'Azyr's Recherches sur la Structure du Cerveau.
Mem. de l'Acad. des Sciences, 1787.

‡ Mais l'entrecroisement des fibres de la mœlle alongée ne peut être démontré en aucune manière, et n'est rien moins que prouvé par l'anatomie.

Boyer's Traité Complet d'Anatomie, tom. 4. p. 63.

being torn, from the tension of the vessels which penetrate it. As these vessels enter the furrow in a direction perpendicular to the medulla, and are not capable of yielding, he supposes that the medulla between each vessel is torn, and gives the appearance of medullary fibres having been divided. *

The fibrous appearance of the medulla oblongata, however, if we even admit that it is completely unequivocal, will not go to the extent of proving, that a decussation of nervous influence takes place in the course of it. *Scëmmering* states, that this fibrous decussation commences immediately below the origin of the lingual nerves ; but it must necessarily have taken place previous to this, otherwise, it appears to me, as I have had occasion to remark above, that

* Je crois pouvoir assurer, non seulement, que les fibres ne souffrent pas d'entrecroisement, mais encore, qu'elles n'existent pas. Elles ne me paroissent être autre chose, que le resultat de l'espèce de déchirure que souffre la möelle de l'épine, par la tension des vaisseaux qui la pénètrent.

Sabatier, l. c. p. 68.

These observations are made on the subject of a supposed crossing of fibres from one side to the other of the spinal marrow. On comparing, however, the passage with the author's remarks on the medulla oblongata at page 43 of the second volume of his *Treatise of Anatomy*, it will be seen, that in the former, as well as the latter, he directs his remarks to the decussation described by *Petit*, and noticed by *Haller*. But as this decussation is represented as occurring in the medulla oblongata, *Sabatier's* observations must necessarily apply, as I have stated them, to a crossing of fibres supposed to take place in that part.

the glosso-pharyngeal and the lingual nerves, which arise in the upper part of the medulla oblongata, could not be affected (as we know they are) by pressure on the opposite side of the head, above the place which Soemmering notes as the commencement of the decussating fibres.

We are completely ignorant of the nature of nervous energy, and know but little of the circumstances under which it is generated, or the conformation necessary for its propagation. The ideas which have been entertained with regard to the brain and nerves, in the endeavour to point out the seat of decussation, are perhaps too mechanical ; and in attempting to account for the mode in which the decussation of nervous energy is effected, we may readily be led into an error, if we form our deductions on this point, merely from an apparent crossing of fibres. The mode in which nature carries on her operations in the head, is very obscure ; but seems to be better capable of being traced by phænomena, than by the examination of structure alone.

Santorini's opinion with regard to the place in which decussation is effected, is, that it occurs in the tuberculum annulare and medulla oblongata. The former idea is somewhat probable ; since the tuberculum annulare is the first link in the chain of communication between the encephalon and spinal marrow : since there is reason to suppose, that the full effect of nervous influence is not produced till

an union of the cerebrum and cerebellum takes place, which seems to be effected in the tuberculum annulare ; and since the circumstances which I have noticed in the course of this paper, are adverse to the idea of decussation occurring either in the medulla oblongata or spinal marrow.

In an endeavour to discover the particular seat of decussation, supposing that it exists, the proper object of inquiry seems to be, not so much as to the place where there may be any real or apparent crossing of fibres, as with regard to that, at which the effects of an injury in any part of the encephalon cease to be propagated in the side in which it was inflicted.

Much important information on this point might be obtained, by a minute attention to the effects which pressure on particular parts of the brain might have on particular nerves ; and if it were found, that pressure on the origin of such nerves as arise from the cerebrum or cerebellum or their crura, previous to their union, affects the same, and not the opposite side of the body, it would furnish some degree of support to the former part of Santorini's opinion.

The contrariety of evidence which at present exists on the subject of the decussation of the optic nerves in the human subject, (into the consider-

ation of which it is unnecessary to enter,) prevents the formation of any conclusion with regard to it, which can affect the general question of decussation in the encephalon; but the evidence which it is endeavoured to bring forward upon this subject, seems to be connected with an admission, that if decussation did take place, an injury of one of the optic thalami would affect the eye of the opposite, and not the same side; if it did not, that it would affect the eye of the same, and not the opposite side. This admission, however, would be improperly made, did it happen that the optic thalami when injured, show the effect on the opposite retina, necessarily and independently of decussation. In fish, where there is an unequivocal decussation of the optic nerves, the retina seems to be placed in some degree under the same circumstances, compared with the optic thalami, as a muscle deriving its influence from a spinal nerve, compared with the opposite side of the head. And the same it is probable would be the case, if decussation were actually found to take place in the optic nerves of the human subject.

The phænomena of hemiplegia are principally confined to such parts as derive their nerves from the medulla oblongata and spinal narrow; and it is a singular, and at present as far as I know, an unaccountable circumstance, that the senses are in

general but little affected in this complaint. Even those nerves which are concerned in mere motion, as the third, fourth, and sixth pairs, which go to the muscles of the eyes, have their powers but little affected; and this is the more remarkable in the sixth or abductors, which originate from the upper part of the medulla oblongata, and therefore may be regarded as similarly situated with the glossopharyngeal, or the lingual nerves, both which are affected by pressure on the opposite side of the brain. Another curious circumstance in the pathology of the nerves is, that where the same nerves are concerned both in motion and sensation, such as those which go to the skin, and perhaps the tongue, (unless we consider it to be completely proved, that the lingual branch of the fifth pair is the actual organ of taste,) the loss of the power of motion, and the loss of sensation are by no means always in the same ratio.

In the case which I related at the beginning of this paper, the left abductor nerve was affected, and consequently the left eye drawn towards the nose, though the paralysis occurred in the right side of the body. This circumstance was occasioned by the pressure of the tumour, on the left nerve of the sixth pair; but I think it likely, from what I consider as the analogy of the other nerves which arise from the medulla oblongata or spinalis, that under no circumstances of immediate pressure on the

origin of one of the nerves of that pair, would the opposite eye be affected. *

When pressure on one of the lobes of the cerebrum or cerebellum is the efficient cause of the production of paralysis, it seems to be communicated to the source of the nerves affected in this complaint, through the medium of the crura ; but as it sometimes happens, that abscesses and tumours of different kinds exist in the brain for a considerable time, without producing paralysis, it is likely, that in order to give rise to it, the pressure should either be more suddenly applied than often takes place in such cases, or should more particularly affect the basis of the encephalon, and through the medium of this, the vertebral column.

The brain has a remarkable power in accommodating itself to gradual derangement ; and in cases where deposition has been made, or growth taken place by slow advances, the act of absorption on the substance of the brain itself, seems to keep pace with the alteration of circumstances, and thus to pre-

* Mr. George William Young, a gentleman distinguished for the accuracy of his anatomical knowledge, mentioned a case to me, in which a distortion inwards of the left eye, was found to be occasioned by a tumour on the left side of the fourth ventricle. As the left nerve of the sixth pair was in this case affected, it tends to support the opinion given above, and seems also to shew, that the origin of this nerve is more distant than is generally imagined.

vent any undue or irregular pressure*. According to the observations of the best writers on the subject, the situation of pressure too, has a considerable effect on the nature and degree of the symptoms produced; for it has been observed, that the nearer it is to the basis of the brain, the more severe are the symptoms produced; and in particular, that when it occurs in the tuberculum annulare, it is more frequently the cause of convulsions, than when it takes place elsewhere.†

It seems to be a salutary provision of nature, that while those parts of the body which are concerned in voluntary motion, are affected in paralysis through the medium principally of the spinal nerves, those which supply organs immediately concerned in the preservation of life, are connected as well with the brain, as with both sides of the spinal marrow. The great sympathetic nerve, by this connection, and by the number of ganglions which occur in the course of it, (which seem to afford an additional source of nervous influence,) is well adapted for preserving, in the vital organs, a species of security against that partial interruption to the propagation of nervous influence, which takes place in paralysis.

* *Bichat* accounts differently for this circumstance. "Au reste," says he, "il ne paroît pas, que chaque hémisphère corresponde toujours, d'une manière nécessaire, avec les nerfs moteurs qui lui sont opposés. En effet, souvent on a observé à droite des épanchemens ou des lésions de la substance cérébrale, sans alteration des mouvemens à gauche & reciproquement." *Bichat's Anatomie Générale*, tom. i. p. 121.

† *Baillie's Morbid Anatomy*, p. 458.

What the final cause may be, of that singular fact in the propagation of nervous energy, to which chiefly I have taken the liberty of requesting the attention of the society in the present paper, it is perhaps impossible to form any rational idea. The mode of its production seems to be principally capable of being discovered, by a minute attention to the symptoms of paralysis, and an accurate observation of the precise seat of morbid appearances in the brain and spinal marrow. The practical utility of such an inquiry, may at first sight appear somewhat problematical; but it nevertheless can hardly be doubted, that every circumstance which may tend to increase our knowledge of the connection of symptoms with diseased appearances, and of the particular course which nervous energy follows in its propagation, must ultimately prove useful.

Since this communication was presented, I have seen in the Edinburgh Medical and Surgical Journal for January 1809, the translation of a very valuable report, on a memoir of Drs. Gall and Spurzheim relative to the anatomy of the brain, by a committee of the National Institute, consisting of Messrs. Tenon, Portal, Sabatier, Pinel and Cuvier.*

In one part of this report, a point of structure is

* The memoir, we are informed, is strictly confined to anatomical observations, and does not at all touch upon the speculations of Professor Gall, on the special functions of the different parts of the brain.

noticed, which is considered as demonstrating the existence of decussation, and pointing out its seat. “ When we separate from each other the two inferior cords of the medulla oblongata and spinal marrow, we see that they are separated by a pretty deep fissure, the bottom of which is occupied by transverse medullary filaments. This fissure is only interrupted at one place, which is what now engages our attention, and which is only two or three lines in length. The fibres of the pyramidal eminence of one side form there, three or four filaments, as the hairs of a mat, and which are blended afterwards with the rest of the medullary cord, into which they thus enter obliquely.”

The authors of the report seem to regard this circumstance of structure, as accounting for the production of paralysis in one side of the body, by injury on the opposite side of the brain; and they express their surprise that a point of structure so evident “ should have been doubted by the great Haller, recently denied by very skilful men, and confounded by others, among whom may be reckoned Vicq d’Azyr himself, with that of the transverse fibres which re-united in their whole length, the lateral parts of the medulla oblongata.”*

* To the authorities mentioned in the report, (those of Winslow, Lieutaud, Portal, and Santorini), as evincing, that this point of structure had been noticed by a former anatomist, but of late unaccountably overlooked, I may add that of Duverney, who designates a similar structure in plate 3, fig. 5, and thus

I have had occasion to notice at page 211, the degree of weight which I consider as attaching to the existence of decussating fibres in the medulla oblongata, and it does not appear to me that the reasoning which I there employed, is affected by the decisive evidence of the existence of decussating fibres afforded by the accurate observations of Drs. Gall and Spurzheim, and of the learned authors of the report made upon their memoir. If we find that pressure on the opposite side of the brain, will affect such nerves as are sent out from the medulla oblongata, above the place where this appearance of decussation is seen, it seems to be evident, that the decussation occurring at this place, and confined to a very small portion of the thickness of the whole column, is not the means by which the phenomenon is produced.

describes it: “Quand on écarte les éminences pyramidales, on voit près de leurs extrémités, deux ou trois trousseaux de fibres, dont les unes passent du côté droit de la moëlle au gauche, & les autres vont dans un sens contraire.”

Duverney, Œuvres, Anatomiques, tom. 1. p. 47.

I have noticed above, the observations of Santorini, but was disposed to consider the opinion of Vicq d'Azyr as conclusive against them. It may be remarked, however, (as I have also stated) that Santorini's observations go to prove, that decussation takes place, as well in the tuberculum annulare, as the medulla oblongata.

Scemmering, I am inclined to think, alludes to this point of structure in the quotation given in the note to page 188.

Should the portio dura of the auditory nerve be affected in paralysis of the face, additional force is given to this argument ; since it has been proved, both by the authors of the memoir, and by the committee to whom we are indebted for the report, that this nerve arises from the medulla oblongata, near its union with the pons varolii, and not from the crus of the cerebellum.